

TWO NEW SPECIES OF *HORISTONOTUS* CANDEZE (COLEOPTERA:
ELATERIDAE), NEW SYNONYMIES, AND A KEY TO THE SPECIES OF THE
UNITED STATES AND CANADA

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Abstract.—Two new species, *Horistonotus bontai*, n. sp., from Georgia and *H. obtusus*, n. sp., from California are described. A key to the species of *Horistonotus* occurring in the continental United States and Canada is given. Additionally, new synonymies are proposed for the following: *H. definitus* Horn 1871 (= *H. sufflatus* LeConte 1853), *H. flavidus* Fall 1901, *H. fidelis* Fall 1934, *H. fidelis fuscus* Fall 1934 (= *H. simplex* LeConte 1863), *H. basalis* Horn 1884, and *H. transfugus* LeConte 1853 (= *H. inanus* LeConte 1853). *Horistonotus vulneratus* Horn 1884 is considered a species of *Cardiophorus*.

Key Words: click beetle, Elateridae, Cardiophorinae, *Horistonotus*

The genus *Horistonotus* was originally proposed by Candèze (1860) to include a group of species allied to the genus *Cardiophorus* Eschscholtz 1829 that possessed an extended margin of the pronotal border and lacked a submarginal pronotal line. Candèze (1860) recognized *H. curiatus* (Say 1839), *H. sufflatus* LeConte, and *H. transfugus* (LeConte) from America north of Mexico. Candèze (1860) had only specimens of *H. curiatus* and did not recognize *H. inanus* (LeConte 1853). Horn's (1884) revision included *H. densus* LeConte 1863, *H. inanus*, *H. transfugus*, *H. definitus* Horn 1871, *H. sufflatus*, *H. simplex*, *H. curiatus*, *H. exoletus* (Erichson 1840), and *H. uhleri* Horn 1871; *H. vulneratus*, *H. pullatus*, *H. basalis*, *H. gracilis*, and *H. mitis* were described as new species. Horn's (1884) recognition of *H. exoletus* as occurring in the southern United States was followed by Schwarz (1906), Leng (1920), Schenkling (1925), Blackwelder (1944), Arnett (1983), and Poole and Gentili (1996). During the present study, the type of *H. exoletus* was

examined. *Horistonotus exoletus* was determined to be a common species restricted to the northern Andes in South America. *Horistonotus exoletus* can be readily distinguished from all other species of *Horistonotus* by the combination of costate apices of the elytral intervals, the very dense propleural punctation (with the punctation being contiguous and appearing granulose), and the bulbous parameres. The above references to *H. exoletus* in the U.S. should be understood as references to *H. uhleri*.

Fall (1901) described *H. flavidus* and distinguished it from *H. simplex* based on color differences. Later, Fall (1934) described *H. pallidus* and *H. fidelis*, and the subspecies *H. fidelis fuscus*. Becker (1973) transferred *H. mitis* to *Esthesopus* Eschscholtz (1829) based largely on the slanted fourth tarsal segment that he considered to be one of the defining characters of the genus *Esthesopus*, which has the fourth tarsal segment lobed beneath. Becker (1973) also separated *Horistonotus* from *Esthesopus* on tarsal length (including the tarsal lobe),

frontal carinae, sternal sutures, shape of scutellum, pronotal margin, and the hypomeron of the hypomeron. Becker (1973) also synonymized *H. pallidus* with *E. mitis*. As currently proposed, the genus *Horistonotus* now contains 13 species from the United States and Canada.

At the species level, the Cardiophorinae represents the most poorly understood subfamily among the Elateridae in North America. This is partly due to the small size of the beetles themselves, but is also a result of difficult distinguishing characters and a confused literature virtually devoid of useful generic treatments. In the present study, the entire *Horistonotus* and *Esthesopus* fauna of the Americas was evaluated. The two genera have been treated as being strictly American although it appears that the Palearctic *Paracardiophorus* Schwarz (1895) is congeneric. It was determined that an adequate treatment of *Horistonotus* as a group would have to wait a thorough generic-level re-evaluation of the subfamily Cardiophorinae of the world. As a result, the study was restricted to only those species of the United States (not including Hawaii, for which no species are known, or Puerto Rico) and Canada. During this study, primary types were evaluated for all species considered except for *H. curiatus* (Say). The specimen believed to represent the holotype of *H. pilosus* Lanchester was found although it had not been adequately labeled.

***Horistonotus bontai* Wells, new species**
(Figs. 1, 5, 8, 12, 16)

Description.—Length (holotype 6.6 mm) 6.4 to 7.5 mm. Width (holotype 1.9 mm) 1.7 to 2.2 mm wide. Testaceous with dense and double vestiture throughout. Head, pronotum, and venter finely and doubly punctate, frons flat to moderately depressed in center, convex on anterior half. Eyes large, diameter of eyes from top to bottom equal to narrowest distance between eyes on anterior half of frons. Frontal margin nearly straight between eyes with slight

downward curvature. Secondary carina reaching frontal margin at a distance from eye less than length of 2nd antennal segment. Antennae extending beyond hind angles of pronotum by 1–2 segments in males and 0–1 segment in females. Pronotum evenly arcuate to base without divergent angles, with two plicae on basal margin, and with median depression on basal third (Figs. 1, 8). Prosternal process curved dorsad behind coxae becoming blunt at apex. Posterior border of mesosternal fossa distinctly porrect laterally. Tarsi with segments 1–4 becoming progressively shorter except segment 5 which is as long as segment 1. Tarsal claws toothed near apex (Fig. 5). Elytral margins nearly parallel on anterior two-thirds becoming evenly arcuate to apex. Elytral intervals costate on apical fourth or more (Fig. 16). Aedeagus narrowing evenly to apex which is bluntly rounded. Paramere parallel sided to near apex where outer edge merges medially to a point at apex just before tip of aedeagus (Fig. 12).

Diagnosis.—*Horistonotus bontai* is most similar to *H. uhleri* and *H. umbilicatus*. It can be distinguished from these species by the margin of the pronotum being evenly arcuate to the base without divergent angles (Fig. 8); *H. uhleri* and *H. umbilicatus* have the basal third of the pronotum sinuate and extending outward at posterior angles (Fig. 9). It is also distinguished from *H. uhleri* by the costate ninth elytral interval reaching the elytral margin near the apex, basad of first elytral interval (Fig. 16); *H. uhleri* has the ninth interval reaching the elytral margin before the apex at the point where the second interval reaches the elytral margin (Fig. 15). *Horistonotus bontai* is also distinguished from *H. uhleri* by the median pronotal depression on the basal third (Fig. 1); the pronotum of *H. uhleri* being evenly convex throughout. It is also distinguished from *H. umbilicatus* by the absence of umbilicate punctures on the pronotum. *Horistonotus bontai* is distinguished from all other nearctic species of *Horistonotus* by the

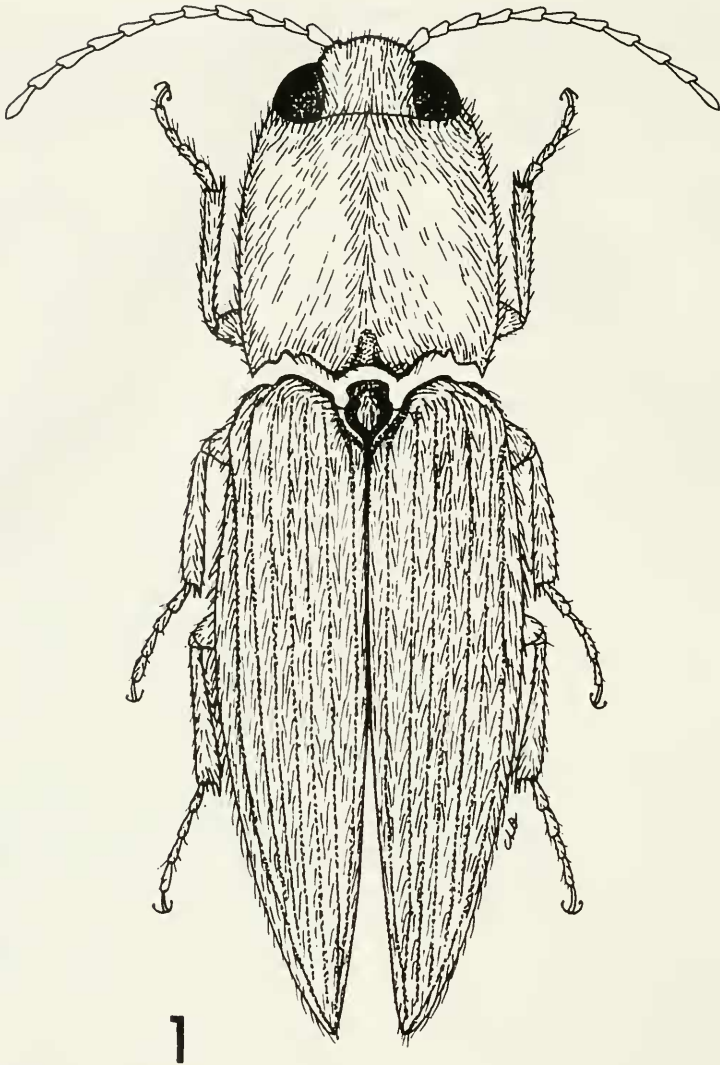


Fig. 1. *Horistonotus bontai*.

apically toothed tarsal claws and the costate elytral intervals that are present on at least the apical fourth of the elytra.

Material examined.—Holotype ♂: Georgia: Glynn Co., Saint Simons Island, Quiresfield, 12-vii-1931. Paratypes: Same as holotype but, 14-vii-1931, C. A. Frost. (7); Georgia: McIntosh Co., Sapelo Island, south end dunes, 30-vi-1985, N. Morgan & C. L. Smith (4); Georgia: Liberty Co., Catherine's island, 23-vi-1978, A. Hook & R. W. Mathews (3).

The holotype and four paratypes are deposited in the Field Museum of Natural History, Chicago, Illinois. Additional paratypes are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC (2); University of Georgia, Athens, Georgia (6); and the author's collection (4).

Etymology.—*Horistonotus bontai* is named in honor of Steve Bonta, a colleague and student of the Coleoptera who has supported my research on click beetles.

***Horistonotus obtusus* Wells, new species**
(Fig. 14)

Description.—Length (holotype 5.6 mm) 5.0 to 7.0 mm. Width (holotype 2.0 mm) 1.9 to 2.2 mm. Testaceous with dense and double vestiture throughout. Head, pronotum, and venter densely and doubly punctate. Frons flat on the disc and evenly arcuate near margins. Eyes small, diameter of eyes from top to bottom nearly 0.75 width between eyes on anterior half of frons. Frontal margin evenly arcuate with secondary carina reaching frontal margin at a distance from eye greater than length of the 3rd antennal segment. Antennae extending beyond hind angles of pronotum by 1–2 segments. Pronotum evenly convex throughout, without median depression, and with two plicae on basal margin. Prosternal process curved dorsad behind coxae becoming blunt at apex. Posterior border of mesosternal fossa slightly porrect laterally. Tarsi densely covered with setae, segments 1 to 4 becoming progressively shorter, except segment 5, which is as long as segment 1. Tarsal claws expanded at base and pointed at apex, without an apical tooth. Elytra widest near middle and deeply punctate striate, intervals slightly convex. Aedeagus narrowing evenly to apex which curves downwards beyond paramere apices. Paramere narrowing on basal half becoming parallel sided to apex, tip blunt with inner side extending further distally than outer side, apical edge slightly concave to notched in some specimens. A single seta arises from the outer margin of each paramere near apex (Fig. 14).

Diagnosis.—*Horistonotus obtusus* is most similar to *H. sufflatus* and *H. pullatus*. It is distinguished from all North American *Horistonotus* by the blunt apices of the parameres, which extend further distally on the inner side. The parameres are also blunt in *H. pullatus*; however, the outer side in *H. obtusus* extends further distally than the inner side (Fig. 11). *Horistonotus obtusus* is also separated from *H. pullatus* by the expanded base of the tarsal claw which in *H.*

pullatus is not expanded. Another distinguishing characteristic is the posterior border of the mesosternal fossa which is moderately porrect laterally in *H. obtusus*, whereas in *H. pullatus* (and *H. pilosus*) the posterior border lacks lateral extensions and rises evenly and abruptly. *Horistonotus obtusus* is also separated from *H. pilosus* by its larger size. *Horistonotus obtusus* is separated from *H. sufflatus* by the relatively smaller punctures on the propleura. In *H. sufflatus* the large punctures are greater than seven times the width of the smaller punctures, whereas in *H. obtusus* the larger punctures are not more than 5 times the width of the smaller punctures. All other species of Nearctic *Horistonotus* can be separated from *H. obtusus* (and *H. pilosus*, *H. pullatus*, and *H. sufflatus*) by the more parallel-sided border of the pronotum. Some forms of *H. inanus* have a constricted pronotal base but these individuals have narrow tarsi with finer setae than in *H. obtusus*, *H. pilosus*, *H. pullatus*, and *H. sufflatus*.

Material examined.—Holotype ♂: California, Fresno, II-12-1934, R.S.W.; Paratypes: Same as holotype (31); California, Fresno, III-19-1933; R.S.W. (18); Helm, 2-12-1934 (3); Helm, 2-13-1934 (1); Helm, 3-5-1933 (2).

The holotype and paratypes are deposited in the James Entomological Collection, Washington State University. Additional paratypes are deposited at the Field Museum of Natural History, Chicago, Illinois and, the author's collection.

An unsigned note attached to the type series indicates that the specimens represent a new species, and that the 1933 material from Fresno was "taken from under cowchips in early spring in the desert country just west of Fresno City".

Etymology.—The specific epithet is a Latin adjective meaning "blunt" and refers to the abruptly terminating apices of the parameres.

KEY TO THE *HORISTONOTUS* SPECIES OF THE UNITED STATES AND CANADA

- 1. Apices of elytra with intervals costate; tarsal claws strongly toothed (Fig. 5) . . . 2
 - Apices of elytra without costate intervals; tarsal claws expanded at base or not, but never strongly toothed (Figs. 2-3) 4
- 2(1). Pronotal punctation umbilicate; frontal carina depressed in anterior view; *umbilicatus* Van Dyke
 - Pronotal punctation double; frontal carina transverse 3
- 3(2). Pronotal margin sinuate on basal third (Fig. 9); costa of interval 9 joining margin before attaining interval 1 (Fig. 15); midline of pronotum evenly convex on basal third (Fig. 9); base of paramere sinuate and more gradually narrowing to tip (Fig. 13) *uhleri* Horn
 - Pronotal margin nearly straight on basal third (Fig. 8); costa of interval 9 joining margin after attaining interval 1 (Fig. 16); pronotum with small median impression on basal third (Fig. 1); base of paramere subparallel before abruptly narrowing to tip (Fig. 12). *bontai*, n. sp.
- 4(2). Posterior margin of pronotum without plicae or indentations; light brown; *lutzi* Van Dyke
 - Posterior margin of pronotum with plicae or indentations (as in Figs. 6-9); color variable 5
- 5(4). Elytra maculate 6
 - Elytra immaculate 7
- 6(5). Elytra dark yellow with a dark macula on posterior half of each elytron.
 - Elytra dark red to black with a pale humeral macula on each elytron; *curiatus* (Say)
 - Elytra dark red to black with a pale humeral macula on each elytron; *inanus* (LeConte) (in part)
- 7(5). Pronotum densely and doubly punctate; area between most large punctures on disc less than 0.5 width of punctures; *densus* LeConte
 - Pronotum moderately punctate, smaller punctures present or absent between larger punctures; nearly all punctures on disc separated by width of punctures or more. 8
- 8(7). Pronotum constricted at base, narrower than base of elytra (Fig. 7); pronotum convex near lateral margins 10
 - Pronotum not constricted at base, same width as base of elytra (Fig. 6); pronotum nearly flattened near lateral margins . . . 9
- 9(8). Black; body narrow, width of elytral base less than length of pronotum *gracilis* Horn

- Rufous to dark brown; body robust, width of elytral base more than length of pronotum *simplex* LeConte
- 10(8). Segments 1, 2, and 5 of protarsi subequal in length and width; tarsal vestiture fine (Fig. 17) *inanus* (LeConte) (in part)
 - Segment 5 of protarsi more slender than segments 1 and 2, and longer than segment 2; tarsal vestiture thick (Fig. 18), segments 1 and 2 with stout ventral setae in addition to more dense thin setae . . . 11
- 11(10). Posterior margin of mesosternal fossa laterally porrect; hindwings fully developed or vestigial; size 5 to 8 mm 12
 - Posterior margin of mesosternal fossa not laterally porrect; hindwings brachypterous or vestigial; size 4 to 5.2 mm 13
- 12(11). Hindwings extend at least to tip of abdomen; large propleural punctures at least 7 times width of smaller punctures; paramere not blunt at apex (as in Fig. 10) with outer margin sinuate to tip *sufflatus* (LeConte)
 - Hindwings vestigial; large propleural punctures less than 5 times width of smaller punctures; paramere blunt or notched at apex, with inner margin longer than outer margin (Fig. 14); *obtusus*, n. sp.
- 13(11). Tarsal claws not expanded at base (Fig. 3); paramere blunt at apex, with outer margin longer than inner margin (Fig. 11) *pullatus* Horn
 - Tarsal claws expanded at base (Fig. 2); paramere not blunt at apex (as in Fig. 10), with outer margin sinuate to tip *pilosus* Lancheester

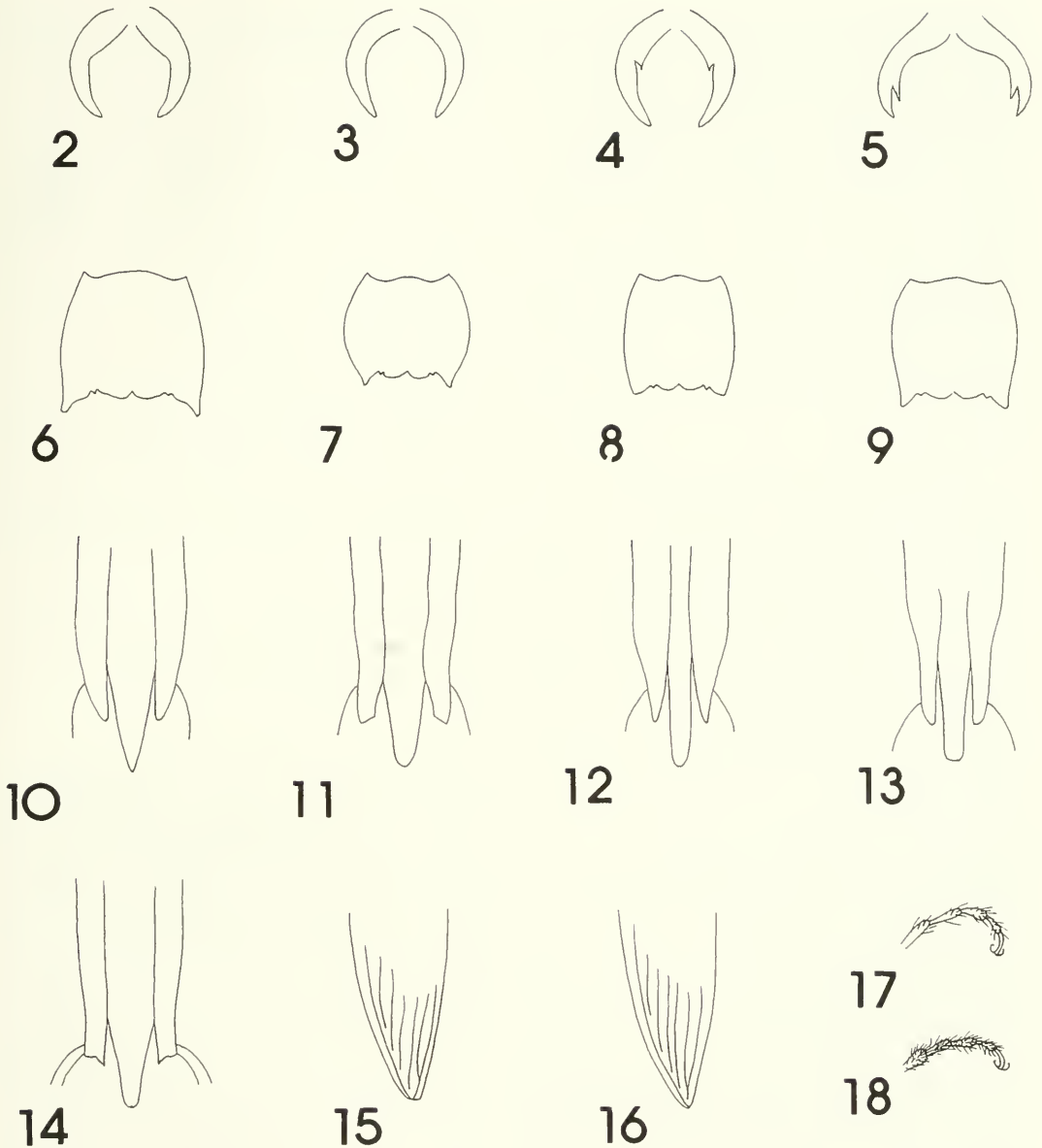
Horistonotus sufflatus (LeConte)

Cardiophorus sufflatus LeConte 1853:499
Horistonotus sufflatus: Candeze 1860:272, Horn 1884:37; Schwarz 1906:177; Leng 1920:175; Schenkling 1925:256; Arnett 1983:53, Poole and Gentili 1996:259.

Horistonotus definitus Horn 1871:302; Horn 1884:37; Schwarz 1906:177; Leng 1920:175; Schenkling 1925:256; Arnett 1983:53; Poole and Gentili 1996:259.

New synonym.

Horistonotus sufflatus can be relatively common under loose rocks on dry sandy soils throughout the southwestern United States. This species apparently has not been taken at lights. This may be partly due to



Figs. 2-18. Tarsal claws, pronota, aediagi apices, elytral apices, and tarsi of *Horistonotus* species. 2, Tarsal claw of *H. pilosus*. 3, Tarsal claw of *H. pullatus*. 4, Tarsal claw of *H. simplex*. 5, Tarsal claw of *H. bontai*. 6, Pronotum of *H. simplex*. 7, Pronotum of *H. pullatus*. 8, Pronotum of *H. bontai*. 9, Pronotum of *H. uhleri*. 10, Aedeagus of *H. simplex*. 11, Aedeagus of *H. pullatus*. 12, Aedeagus of *H. bontai*. 13, Aedeagus of *H. uhleri*. 14, Aedeagus of *H. obtusus*. 15, Elytral apex of *H. uhleri*. 16, Elytral apex of *H. bontai*. 17, Anterior tarsus of *H. inanus*. 18, Anterior tarsus of *H. sufflatus*.

reduced hindwings in many individuals; whereas, *H. simplex*, which has fully developed hindwings (and which is much more common in collections), does come to lights.

The characters used by Horn (1884) to distinguish *H. definitus* from *H. sufflatus* are not consistent. In several localities, intermediate populations exist. Large specimens tend to be lighter brown with denser

pronotal punctation, whereas smaller specimens tend to be darker brown with less pronotal punctation. Punctation appears to diminish allometrically with size with intermediate forms of punctation and coloration occurring throughout the range of the species. The darker smaller forms of *H. sufflatus* can be quite similar to *H. pullatus* but are differentiated by the expanded base of the tarsal claws in *H. sufflatus* and by the blunt paramere apices in *H. pullatus*. Both species have thick setose tarsi that may be an adaptation to the sandy habitats in which they live.

Horistonotus simplex LeConte

Horistonotus simplex LeConte 1863:83; Horn 1884:38; Schwarz 1906:177; Leng 1920:175; Schenkling 1925:256; Arnett 1983:53; Poole and Gentili 1996:259.

Horistonotus flavidus Fall 1901:240; Leng 1920:175; Schenkling 1925:256; Arnett 1983:53. **New synonym.**

Horistonotus fidelis Fall 1934:21; Arnett 1983:53; Poole and Gentili 1996:259. **New synonym.**

Horistonotus fidelis fuscus Fall 1934:22; Arnett 1983:53. **New synonym.**

Horistonotus fuscus: Poole and Gentili 1996:259.

Horistonotus simplex is probably the most commonly collected species of the genus in the southwestern U.S. and northern Mexico. Throughout its range it varies in color from nearly yellow in some southern California and Arizona populations to dark reddish brown in the more northern parts of its range. These color differences were the major specific criteria used by Fall to distinguish *H. flavidus*, *H. fidelis*, and *H. fidelis fuscus*. An evaluation of more material from areas between these isolated populations shows that coloration and size intergrade without clearly defined geographical boundaries. In southern California and southern Arizona, all color variations occur without an apparent pattern. Several series of specimens in this area are from single

populations that vary from light brownish orange to reddish brown.

Horistonotus inanus (LeConte)

Cardiophorus inanus LeConte 1853:499

Horistonotus inanus: Candeze 1860:273; Horn 1884:37; Leng 1920:175; Schenkling 1925:256; Arnett 1983:53; Poole and Gentili 1996:259.

Horistonotus incanus Schwarz 1906:177. Unjustified Emendation.

Cardiophorus transfugus LeConte 1853:500. **New synonym.**

Horistonotus transfugus: Candeze 1860:273; Horn 1884:37; Schwarz 1906:177; Leng 1920:175; Schenkling 1925:255; Arnett 1983:53; Poole and Gentili 1996:259.

Horistonotus basalis Horn 1884:36; Schwarz 1906:177; Leng 1920:175; Schenkling 1925:255; Arnett 1983:53; Poole and Gentili 1996:259. **New synonym.**

Horistonotus inanus was described by LeConte (1853) from two specimens collected from San Diego, California. This form of *H. inanus* is representative of small black populations and can also be recognized by fine pronotal punctation and with a fine pale coloration (but lacking maculae) on the base of the elytra. LeConte (1853) likewise described *H. transfugus* from one specimen from San Jose (supposedly in California) with distinct light coloration on the base of the elytra. Many northern populations of this form can also be distinguished from the small black form of *H. inanus* based on the curvature of the pronotal margin, the northern form being less sinuate. Horn's (1884) description of *H. basalis* was based on material from Owens Valley, California, exhibiting humeral coloration and a sinuate pronotal margin. He also distinguished dark specimens resembling *H. inanus* that had relatively denser pronotal punctation than LeConte's species. In isolated populations, these specimens are all readily separated from the small black

form of *H. inanus*. Examination of much larger series from southern California, however, shows a broad area of overlap between *H. inanus* and *H. basalis* where the clearly defined maculae and denser pronotal punctation of *H. basalis* blend completely into diffuse pale coloring and finer punctation evidenced in *H. inanus*. Around Lake Tahoe, California, *H. transfugus* similarly blends in with forms of *H. basalis*. The trend in *H. inanus* thus ranges from small and black populations in southeastern California, Arizona, and Nevada to small dark brown populations with pale humeral maculae in southern California extending into northwestern California, to populations in south central California also exhibiting pale humeral maculae but with a less sinuate pronotal margin, and larger size.

Horistonotus pilosus Lanchester

Horistonotus pilosus Lanchester 1971:48

The holotype of *H. pilosus* is now deposited in the "USNM" (understood to be the United States National Museum) which was the originally intended place of deposition indicated by Lanchester. During this study, the type was located in a drawer of miscellaneous click beetles at the James Entomological Collection at Washington State University (WSU) without a type-designation label. This material was part of the Horace Lanchester collection donated to WSU. The specimen was labelled as "*pilosus* n. sp." and was collected from Toppenish, Washington as indicated in Lanchester's original description.

Horistonotus pilosus resembles *H. sufflatus* but can be separated by the smaller size and reduced metathoracic wings. *Horistonotus pilosus* appears to be restricted to west-central Washington from Douglas County south to Yakima and Benton counties. One specimen collected by R.S. Zack in Benton County was collected in May from flowers of *Balsamorhiza careyana*. It is not known if the larvae feed on the roots of this plant.

Cardiophorus vulneratus (Horn)

Horistonotus vulneratus Horn 1884:35; Schwarz 1906:176; Leng 1920:175; Dietrich 1945:61; Arnett 1983:53; Poole and Gentili 1996:259.

Cardiophorus vulneratus: Champion 1895: 417.

Cardiophorus vulneratus (Horn) clearly belongs in the genus *Cardiophorus* by the presence of the submarginal pronotal line. Champion (1895) transferred the species from *Horistonotus* to *Cardiophorus* and indicated the need for a new name for *C. vulneratus* Candeze from Burma (now Myanmar). Champion's efforts (published in *Biologia Centrali Americana*) seem to have gone unnoticed by catalogers since publication, although Dietrich (1945) mentioned that *H. vulneratus*, from Arizona, should be transferred to *Cardiophorus*. The specimen referred to by Dietrich (1945) from New York was almost certainly mislabeled as the species is restricted to the southwestern U.S. and Mexico. Dietrich (1945) mentioned the dubious nature of this locality.

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LITERATURE CITED

- Arnett, R. H. 1983. Family 52, Elateridae, pp. 53–54. *In* Checklist of the Beetles of North and Central America and the West Indies.
- Becker, E. C. 1973. A new species of *Ctenicera* from southern California and a re-evaluation of the differences between the nearctic species of *Esthesopus* and *Horistonotus* (Coleoptera: Elateridae). *Canadian Entomologist* 105: 1529–1534.
- Blackwelder, R. E. 1944. Checklist of the Coleopterous insects of Mexico, Central America, the West Indies, and South America. Part 2, pp. 189–342. U.S. Government Printing Office, Washington, D.C.
- Candeze, M. E. 1860. Monographie des Elaterides. *Memoirs de la Société Royale des Sciences de Liege*, Vol. 3, pp. 243–274.
- Champion, G. C. 1895. Insecta, Coleoptera (Elateridae), Vol. 3, pt. 1, pp 258–556. *In* *Biologia Centrali-Americana*.
- Dietrich, H. 1945. The Elateridae of New York State. *Cornell University Agricultural Experiment Station Memoir* 269. 79 pp.
- Erichson, W. F. 1840. Über elateriden ohne Bruststachel (*Cardiophorus*). *Zeitschrift für die Entomologie*, Vol. 2, heft 2, pp. 279–341.
- Eschscholtz, J. 1829. Elaterites, Eintheilung derselben in Gattungen. *Entomologisches Archiv* 2(1): 31–35.
- Fall, H. C. 1901. List of the Coleoptera of southern California. *Occasional Papers of the California Academy of Sciences*. viii, pp. 1–282.
- . 1934. On certain North American Elateridae, new and old. *Journal of the New York Entomological Society* 42: 7–36.
- Horn, G. H. 1871. Description of new species of Elateridae of the United States. *Transactions of the American Entomological Society* 3: 299–324.
- . 1884. A study of some genera of Elateridae. *Transactions of the American Entomological Society* 12: 33–52.
- Lanchester, H. P. 1971. Subfamily Cardiophorinae, pp. 35–48. *In* Hatch, M. H., *The Beetles of the Pacific Northwest, Part V*. University of Washington Press, Seattle, 662 pp.
- LeConte, J. L. 1853. Revision of the Elateridae of the United States. *Transactions of the American Philosophical Society* 10: 405–508.
- LeConte, J. L. 1863. New species of North American Coleoptera. *Smithsonian Miscellaneous Collections*. 167, pp. 1–92.
- Leng, C. W. 1920. Catalogue of the Coleoptera of America, North of Mexico. John D. Sherman, Jr., New York, 470 pp.
- Poole, R. W. and P. Gentili, eds. 1996. *Nomina Insecta Nearctica, Vol. 1: Coleoptera, Strepsiptera*. Entomological Information Services, Rockville, Maryland, 827 pp.
- Say, T. 1839. Descriptions of new North American insects, and observations on some already described. *Transactions of the American Philosophical Society* 20: 155–190.
- Shenkling, S. 1925. Elateridae I, pp. 1–263. *In* *Coleopterorum Catalogus* 81: 255–259. W. Junk, Berlin, Eds.
- Schwarz, O. 1895. Ueber *Cardiophorus musculus* Er. Als Vertreter einer besonderen Gattung. *Deutsche Entomologische Zeitschrift* 1: 39–40.
- . 1906. Coleoptera, family Elateridae, pp. 113–124. *In* Wytsman, P., *Genera Insectorum*, Fascicle 46B.